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(54) Egg setting tray and system

(57) Incubating eggs are supported in trays mounted one above another, the air sac ends of the eggs in a tray being illuminated locally by individual beams of light from localised light outlets of a light guide or guides receiving light from an external source and forming part of the tray, of a vertically adjacent tray, or of a vertically adjacent tray-illuminating overlay.

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FIG. 1

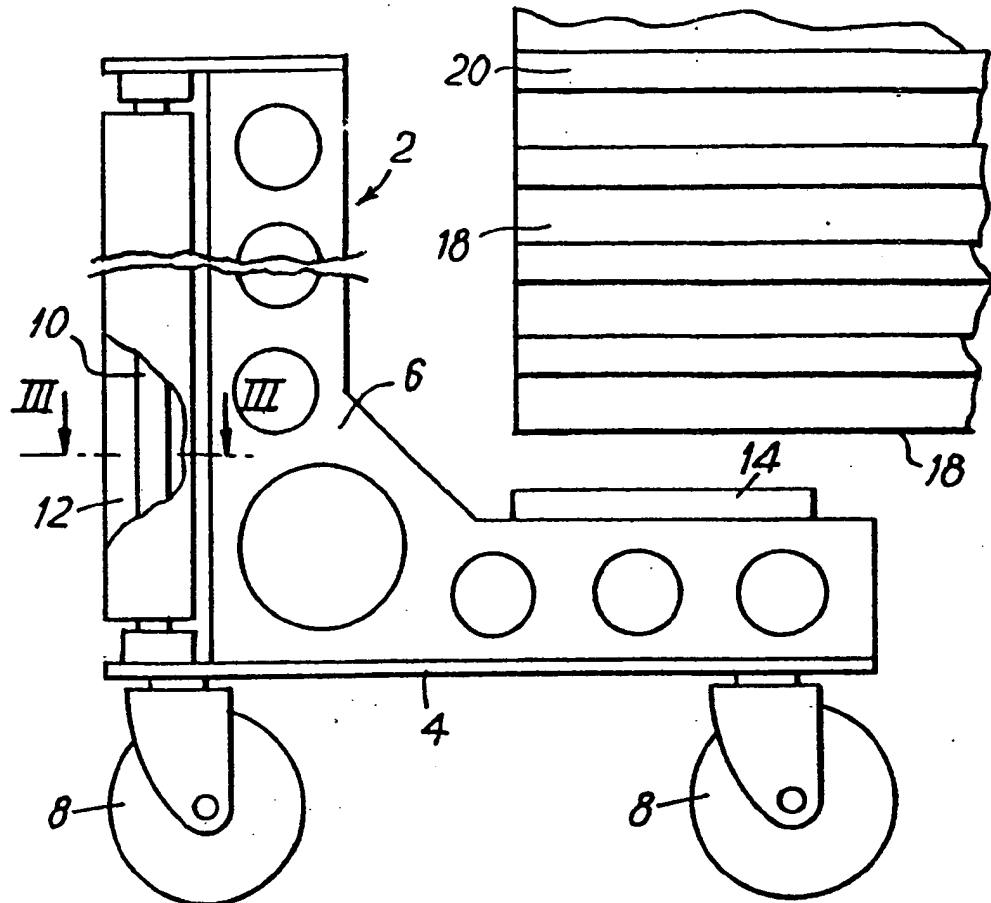


FIG. 2

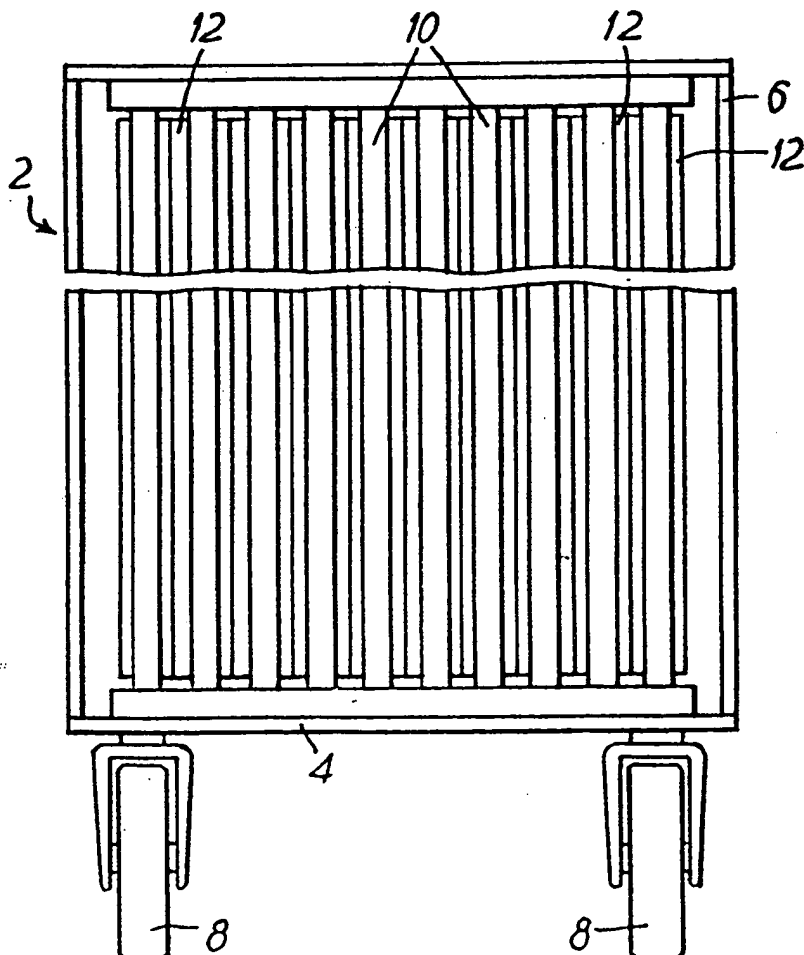


FIG. 3

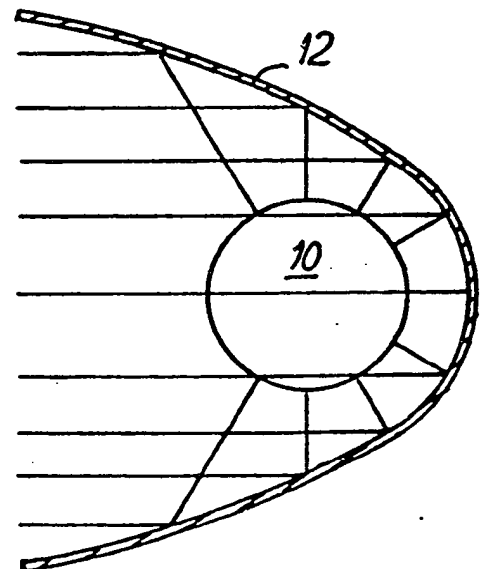


FIG. 4

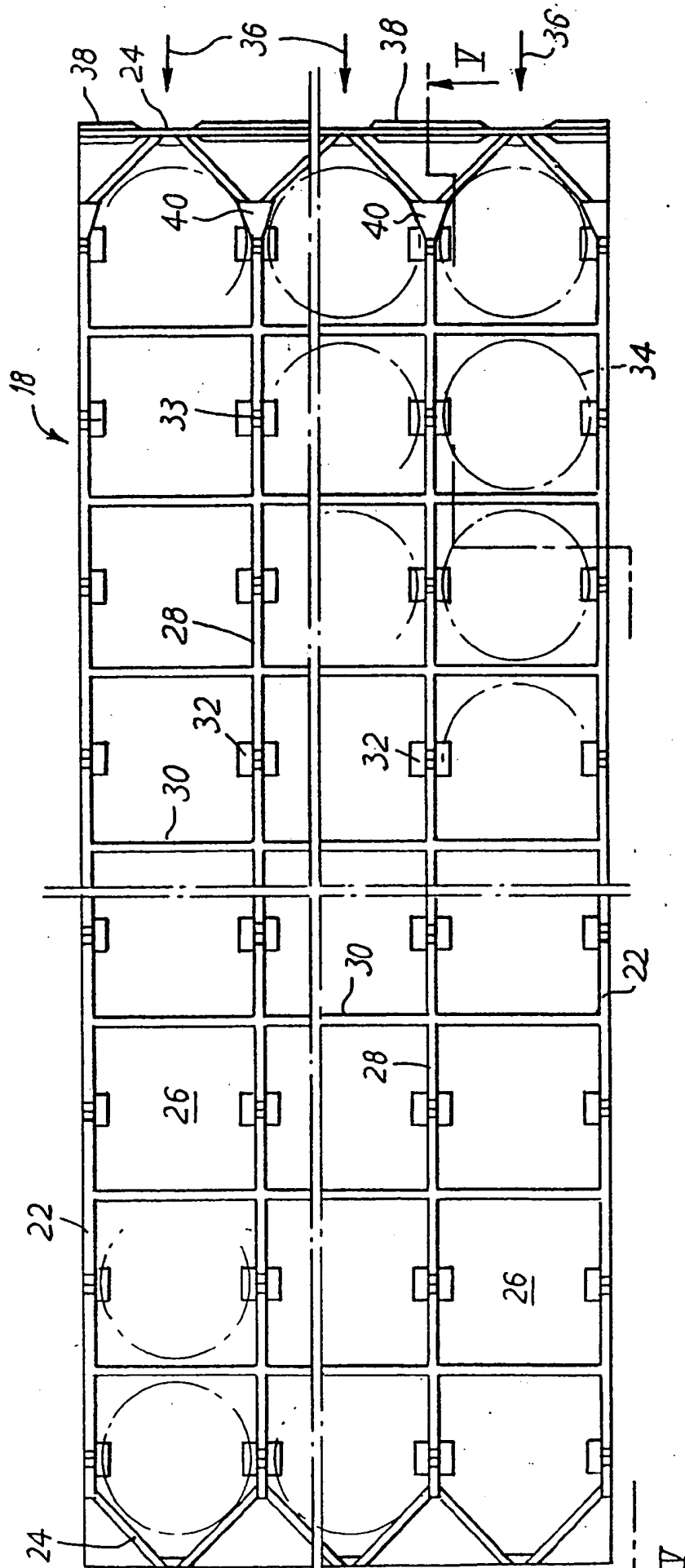


FIG. 5

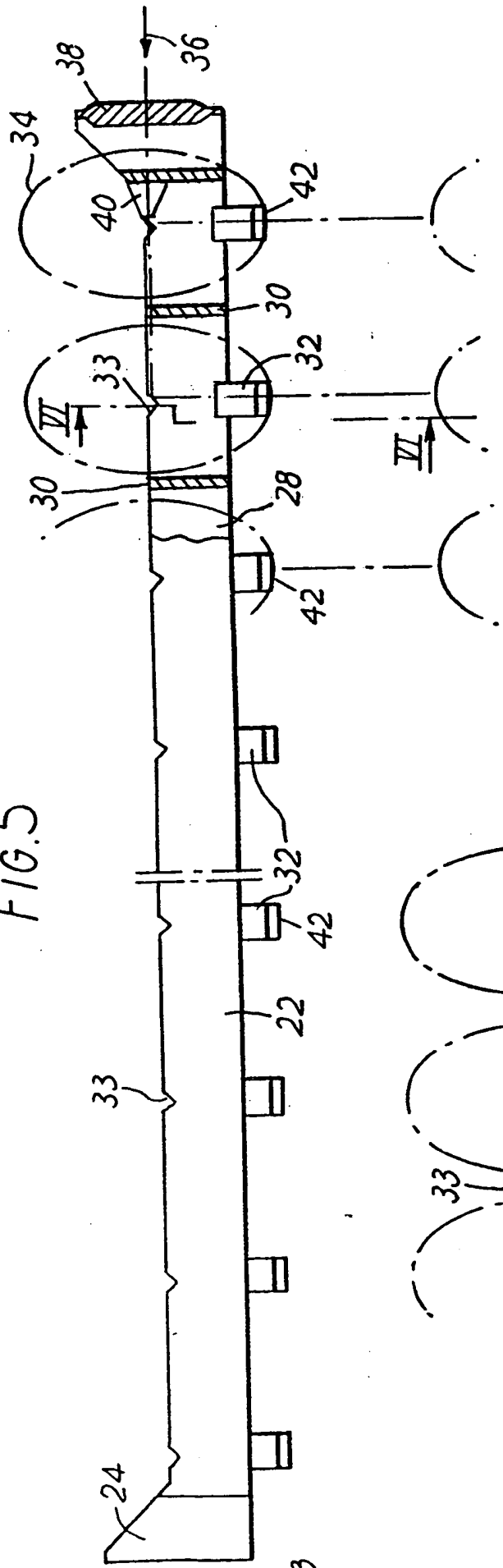


FIG. 6

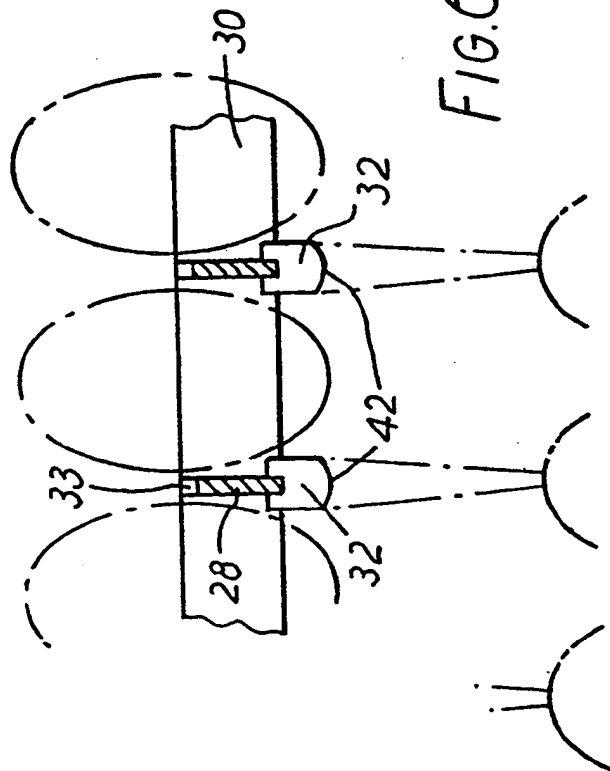
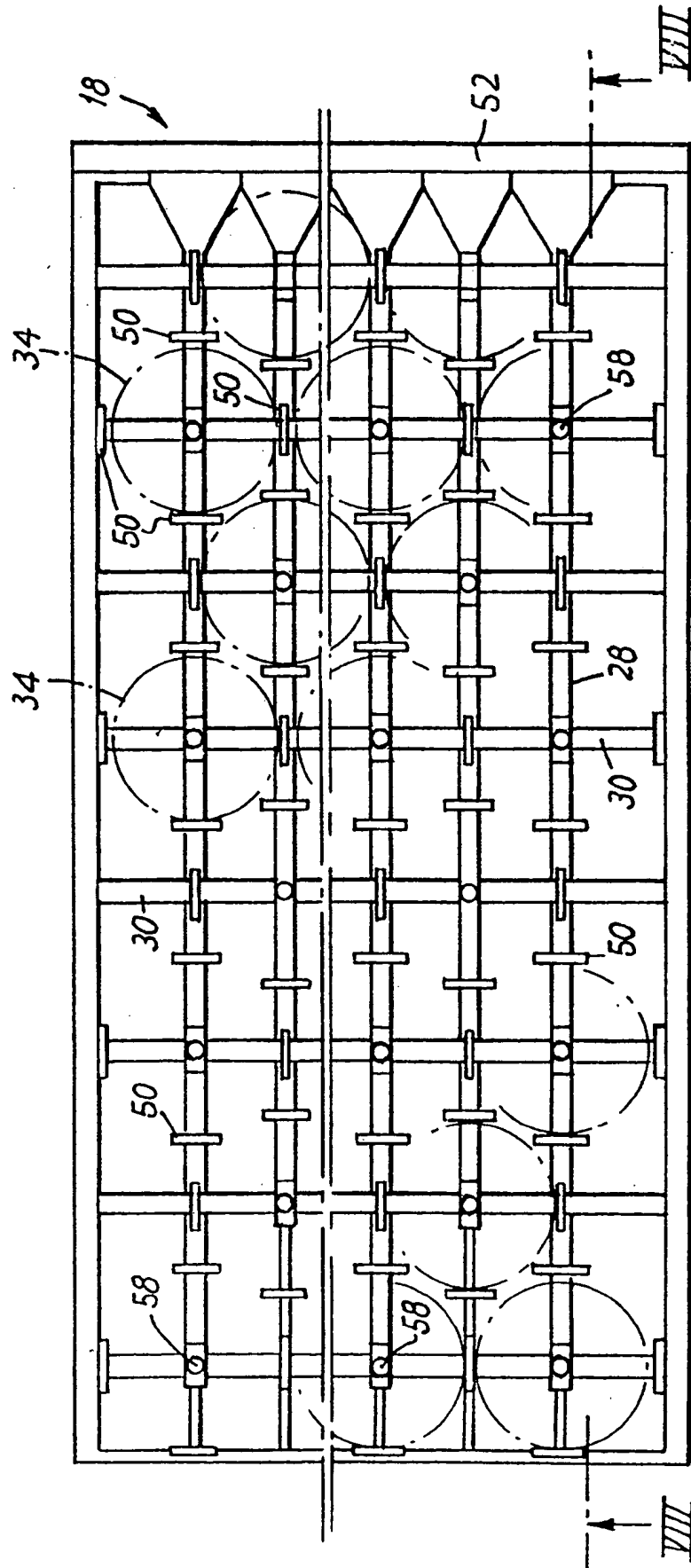


FIG. 7



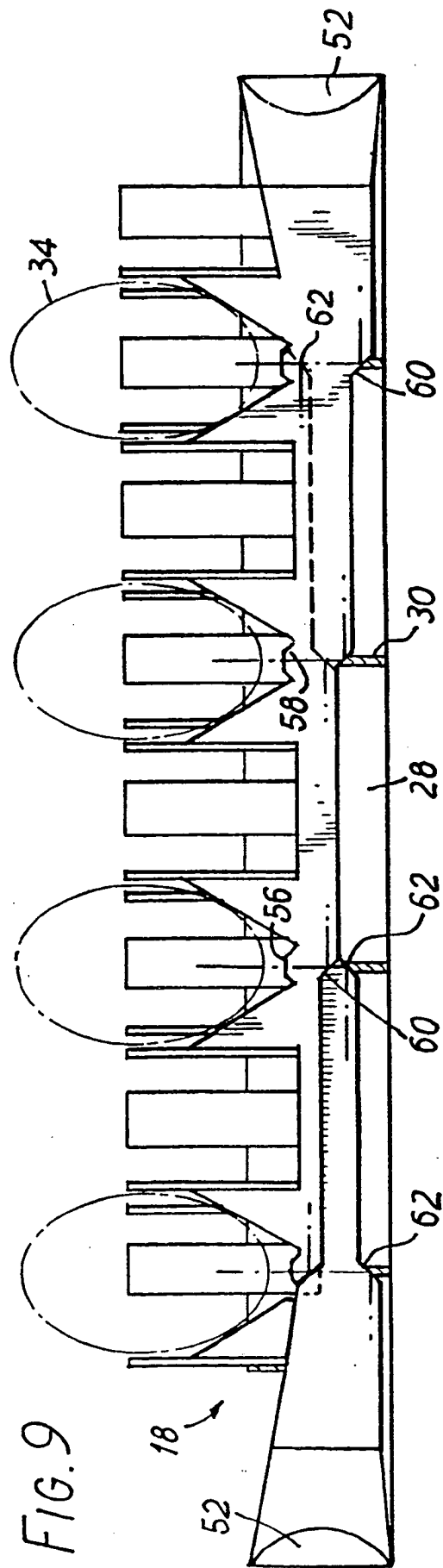
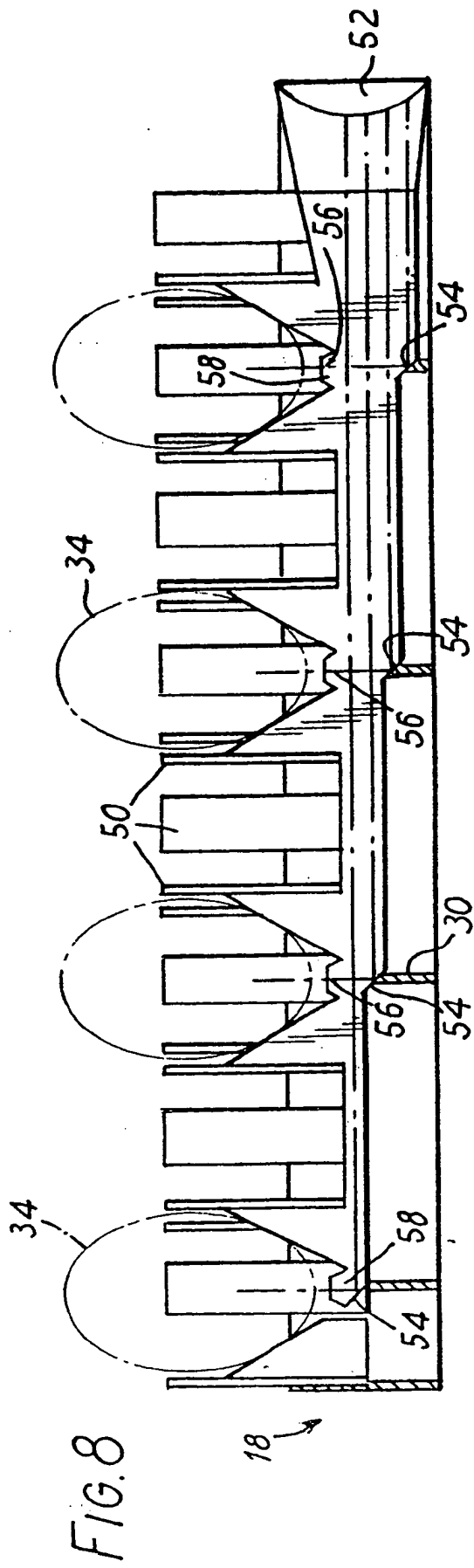


FIG. 12

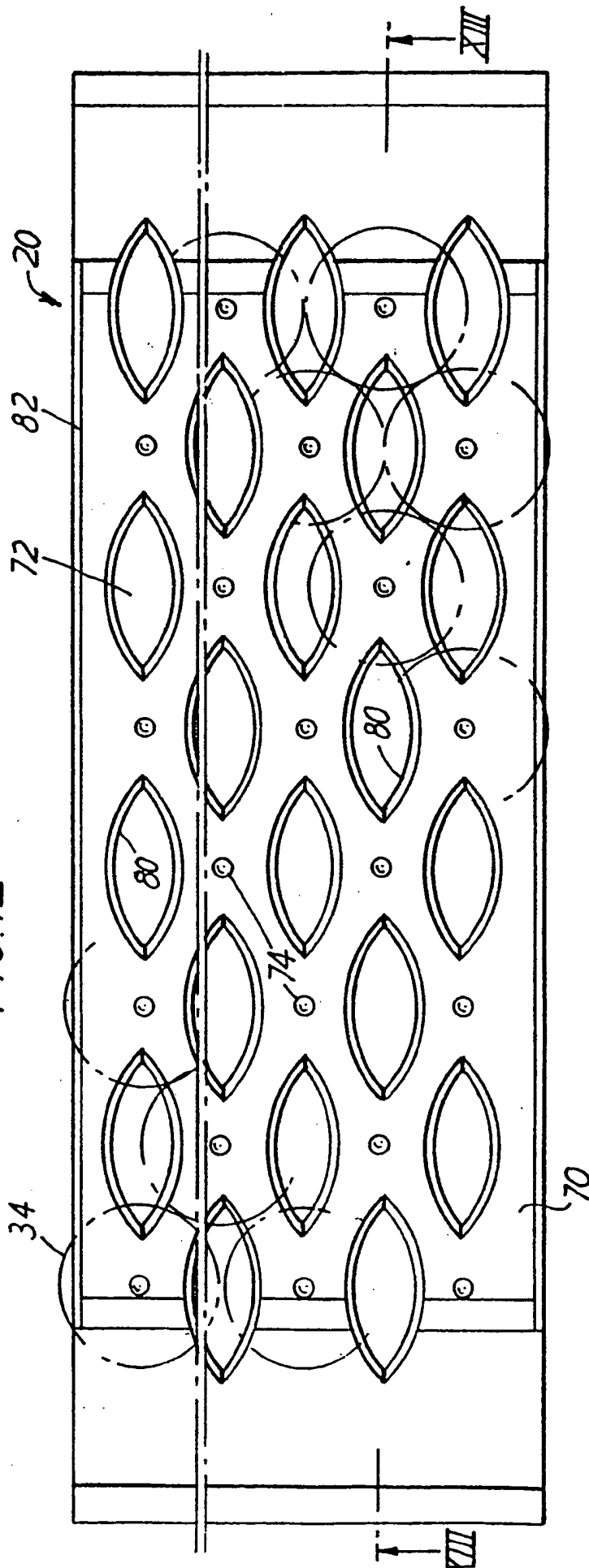
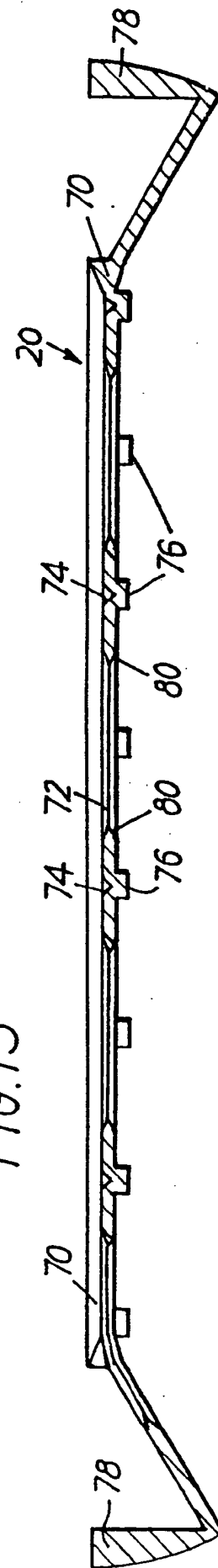


FIG. 13



SPECIFICATION

Egg setting tray and system

5 This invention concerns the artificial incubation of eggs. Of particular practical concern is the artificial incubation of chicken eggs, but the invention is equally applicable to the artificial incubation of other hard-shelled eggs.

10 Such eggs are conventionally incubated artificially on trays each having a surface provided with receptacles (e.g. recesses or holes) to accommodate individual fertilized eggs, the loaded trays being placed and maintained (usually mounted in spaced relationship one above the other) in an environment conducive to incubation of the eggs which they carry.

15 Illumination of the incubating eggs, and of their air sac ends in particular, can improve early embryonic growth and consequent hatching success and chick life and performance, giving incubation results improved in comparison with those obtained without such illumination.

20 Heretofore it has not been possible to effect such local illumination of the incubating eggs uniformly and with economic and efficient use of the light.

25 The present invention provides a method of incubating eggs in which the incubating eggs are supported in an array on a tray and are illuminated locally at their air sac ends by an array of individual light beams from an array of localised individual light outlets spaced apart over light guide means receiving light from an external source and constituting at least part of the tray or of a vertically adjacent member or members generally co-extensive with the tray. It also provides egg incubation apparatus comprising egg support means providing receptacles disposed in a first array for holding respective individual eggs in a corresponding array, and light 30 guide means extending adjacent to the first array and disposed to receive light from an external source, the light guide means having individual localised light outlets which are spaced apart in a second array to direct such received light locally 35 towards an end of each receptacle.

40 Generally the method and apparatus according to the invention will employ a plurality of egg setting trays mounted one above another, with local illumination for one tray being supplied by light guides provided by that tray, by an adjacent tray, or by an additional vertically adjacent illuminating component. The invention thus provides an egg setting tray incorporating an array of receptacles for holding respective individual eggs and, extending adjacent 45 to the array, a light guide or guides having portions able to receive light from an external source and having individual localised light outlets which are spaced apart over the tray for locally directing such received light away from at least one face of the tray in an array of individual beams; and an egg setting 50 tray incorporating an array of receptacles for holding respective individual eggs and, extending adjacent to the array, a light guide or guides having portions able to receive light from an external source and having individual localised light outlets which are 55

60 spaced apart to direct such received light locally to an end of each receptacle of the tray. It also provides an illuminating overlay for an egg setting tray, the overlay comprising a light guide or guides having portions able to receive light from an external source and having individual localised light outlets which are spaced apart in an array to direct such received light locally away from at least one face of the overlay in a corresponding array of individual beams.

65 The light guides could be supplied as initially separate members for attachment to a pre-existing tray or pre-formed overlay support, but they preferably form a structural part of the tray or overlay to which they belong; thus in a tray, the receptacles are preferably defined at least partially by the light guides, and the trays and overlays according to the invention are in fact preferably integrally moulded units of light-transmitting material each constituting a composite light guide.

70 There is also provided a lighting trolley for use in the method and apparatus of the invention.

75 In one application of the invention, the eggs are carried in conventional manner, air sac upwards, on a number of egg setter trays spaced one above the other in a stack, each tray providing receptacles disposed in an array and holding respective individual eggs in said array, e.g. in a square packing or hexagonal close packing arrangement. Each tray has light guides extending between the eggs in its array, with individual localised light outlets which are spaced along the lengths of the light guides in a second array and which direct light downwardly and locally onto the upper ends of the eggs carried by the tray below. The light outlets of one tray will usually be disposed between the egg receptacles, i.e. in an array offset from the egg receptacle array, with the egg receptacles in the tray below being disposed in register with the light outlets of the tray above. Most conveniently, the egg setter trays are of conventional grid or mesh form in the holes through which the eggs sit, but with at least some of the walls defining the grid or mesh being of light-transmitting material and constituting the said light guides; the whole tray may be moulded as an integral unit in 85 light-transmitting material, e.g. a transparent plastics material such as a polyacrylate plastics, the runners defining the grid or mesh constituting the light guides with their localised light outlets. Each light outlet may for example be provided by forming the light guide at the position required with a re-entrant or angled portion in one surface, so that light travelling along the guide and encountering this surface is reflected out through the opposite face of the guide; the light may pass out through a stud or projecting portion of the light guide whose exit face may be concave or convex according to whether the emitted light is to be spread or focussed. With this embodiment it is thus impossible to employ existing equipment for stacking the trays, and to use trays which are of conventional shape and structure but which are of transparent material providing the required light guides. As a practical matter, the top tray in a stack is conveniently left empty, and the bottom tray need not of course incorporate any light guides.

90 In another type of embodiment an egg setter tray

incorporates light guides with individual localised light outlets which illuminate the eggs carried by the said tray, rather than those carried by another tray. Such a tray may for example have a base with

- 5 upstanding projections defining an array of receptacles for holding the eggs air sac downmost. The tray base then incorporates light guides or itself constitutes a light guide having individual localised light outlets through which light is directed upwardly
10 through the base of each receptacle. Once again, the whole tray may be of light-transmitting material such as polyacrylate or other transparent plastics material. If the eggs are to be accommodated air sac uppermost, projections from the tray base may
15 extend to the tops of the eggs and themselves constitute part of the light guide(s) with light outlets in these projections directing light laterally at the upper ends of the eggs. In a modification of the latter arrangement, the receptacles are shaped to hold the
20 eggs on their sides, with light outlets in the projections directing light end on at the air sacs of the eggs. These self-illuminating types of tray will also normally be employed in a vertical stack.

- In a different type of embodiment, the eggs are
25 illuminated by means of an overlay mounted over the egg setter tray and having light guides with localised light outlets which locally direct light downwards onto the upper ends of the eggs carried on the tray. In this way, wholly conventional existing
30 equipment can be employed, with the addition of the overlays and an appropriate light source therefor. The overlay is conveniently moulded as an integral sheet of light-transmitting material; an array of conical indentations formed in the upper surface of the
35 overlay will reflect light downwards and out through the under surface of the overlay from a corresponding array of localised light outlets disposed in register with the egg receptacles provided by the associated tray below. The overlay is preferably also
40 formed with an array of perforations or relatively large holes therethrough to allow for adequate ventilation. The internal and external edges of the overlay are preferably shaped for maximum internal reflection of light, so as to reduce the dissipation of light
45 from its outer edge and the edges of any ventilation holes. The egg setter trays will normally be employed in a vertical stack, each provided with its own locally illuminating overlay.

- The illuminating trays and/or overlays employed
50 according to the invention may obtain their light from one or more separate external light sources. An external light source, when employed, is preferably in the form of a mobile trolley carrying an upright battery of light sources (e.g. upright or horizontal
55 fluorescent tubes mounted side by side) backed by a reflector or reflectors which may be flat, or of any conic or polygonal section; such a trolley can then be employed to illuminate simultaneously a number of the trays and/or overlays mounted one above the
60 other in a stack, and can be moved from stack to stack as required. Alternatively, each individual tray or overlay may have its own light source or sources, e.g. a fluorescent tube mounted parallel to an edge of the tray or overlay. In either case, the light will
65 preferably be collected for transmission to the tray

or overlay by means of at least one lens associated with or integral with the tray or overlay. The or each lens may thus be moulded integrally with the tray or overlay, or could for example be a separate item which clips onto the tray or overlay. The trays or overlays may be designed for receipt of illumination along one edge only, or along more than one edge, e.g. along opposite edges.

- 70 Trays according to the invention may also be provided with means for controlling the temperature of the individual eggs accommodated thereby, e.g. by incorporated means for conducting infrared radiation, or channels for heating or cooling air.

Embodiments of the invention will now be described, purely by way of example, with reference to the accompanying drawings, in which like elements are identified by like reference numerals, and in which:—

FIGURE 1 is a side elevation view, part broken away, of an illuminating trolley according to the invention;

FIGURE 2 is a front elevation view of the trolley along lines II-II of Fig. 1;

FIGURE 3 is a plan view, in section, on lines III-III of Fig. 1, of an individual fluorescent tube and associated reflector.

FIGURE 4 is a schematic fragmentary plan view of an egg setting tray according to the invention;

FIGURES 5 and 6 are elevation views, in section, along lines V-V and VI-VI of Figs. 4 and 5 indicating schematically the localised illumination by the Fig. 4 tray of eggs carried in a tray below;

FIGURE 7 is a schematic fragmentary plan view of a further egg setter tray according to the invention designed for illumination along one edge only;

FIGURE 8 is an elevation view in section along lines VIII-VIII of Fig. 7;

FIGURE 9 is a view similar to that of Fig. 8 of a modification of the Fig. 7 tray designed for illumination along opposite edges;

FIGURE 10 is a schematic fragmentary plan view of a third egg setter tray according to the invention;

FIGURE 11 is an elevation view in section along lines XI-XI of Fig. 10;

FIGURE 12 is a schematic fragmentary plan view of an illuminating overlay according to the invention; and

FIGURE 13 is an elevation view, in section, along lines XIII-XIII of Fig. 12.

- 115 The illuminating trolley 2 shown in Figs. 1 to 3 of the accompanying drawings comprises a base 4 and casing 6 mounted on wheels 8 and carrying a bank of vertical side-by-side fluorescent tubes 10 provided with individual aluminium reflectors 12. The fluorescent tubes may for example be 180 centimetres long, with the trolley being about 205 centimetres tall overall. Switches, starters and ballast chokes provided in module 14 may be connected to the mains supply and to the fluorescent tubes 10. As indicated
120 in Fig. 3, the reflectors 12 receiving light from tubes 10 each produce a substantially parallel beam of reflected light. As indicated purely diagrammatically in Fig. 1, the trolley 2 can be wheeled into operative illuminating relationship with a stack of egg setter
125 trays 18 and/or tray overlays 20 according to the

invention.

Figures 4 to 6 illustrate one egg setter tray according to the invention suitable for use with an illuminating trolley as shown in Figs. 1 to 3. This tray 18 is an integral moulded body of transparent acrylic resin in the form of a square mesh grid having two opposed straight walls 22 and two opposed indented walls 24. The square meshes 26 of the grid are defined variously by the mentioned side walls 22 and 24 and runners 28 and cross pieces 30, all of which are integral with one another. The base of each runner 28 has a laterally enlarged portion 32 midway along each mesh 26; chicken eggs, indicated by broken lines as at 34 sit, air sac uppermost, in the respective individual meshes 26, (which number e.g. 10 x 15), supported by the enlarged runner base portions 32. Light from a source which is not shown but which may be a trolley as illustrated in Figs. 1 to 3 is directed to the right-hand edge of tray 18 as seen in Fig. 4 and is shown by the arrows 36. This light from an external source is collected by Fresnel lenses 38 which clip into the mouths of the indentations in the side 24 and which direct the light to the frusto-conical light-receiving ends 40 of runners 28. Runners 28, cross pieces 30, and the side walls 22 and 24 constitute light guides from which light dissipation is concentrated substantially at spaced light outlets which are the bases 42 of enlarged runner portions 32. As shown, the upper face of the runner opposite each enlarged portion 32 is V-grooved at 33 to reflect a portion of the light travelling along runner 28 downwardly and out through the base of the enlarged portion 32. The base of each enlarged portion may be convex for focussing or plane, in which case the light issuing will spread; if desired, the outlet surface could instead be concave, in which case issuing light will spread further. In practice, the trays 18 would be mounted spaced one above another in a stack in the manner indicated schematically in Fig. 1, with the eggs in one tray offset from those in the tray above so as to be in register with the light outlets 42 of the tray above. The uppermost air sac ends of all of the eggs in the incubation unit may thus be illuminated in a controlled and uniform manner by light guided through and locally emitted from the tray above. The uppermost loaded tray will be illuminated by an empty tray mounted above it. The tray 18 illustrated in Figs. 4 to 6 is of conventional shape and structure, and so can be used with existing conventional tray supports. The tray illustrated employs square packing of the eggs, but other conventional tray configurations, for example providing hexagonal close packing, can equally well be used.

Figs. 7 and 8 illustrate a different type of tray according to the invention whose light guide means have localised light outlets which direct light to illuminate locally the air sac ends of eggs carried by the tray itself. This tray 18 provides for hexagonal close packing of the eggs which are indicated by broken lines as at 34. The eggs are supported, in this case air sac downwards, by symmetrically disposed members 50 upstanding from the base of the tray which is a square mesh defined by runners 28 and cross pieces 30, the whole tray being an integral

moulding of transparent plastics material. The tray 18 is designed to be illuminated from the right-hand side only (as viewed in Figs. 7 and 8) as in the case of the embodiment of Figs. 4 to 6. In this case a single Fresnel lens 52 is provided, extending the full length of the said right-hand side of the tray, to collect light from the external light source and direct it to the receiving end of the runners 28; in this case, the lens 52 is formed as an integrally moulded part of the tray 18 itself. The underside of each runner 28 has angled reflecting surfaces 54, offset from one another along the length of the runner, which reflect light travelling along the light guide (runner) 28 out through the corresponding localised light outlets 56 constituted by the frusto-conical projections 58 formed in the upper surface of the runner and constituting the bases of the egg receptacles. As in the case of the embodiment of Figs. 4 to 6, the outlet surface of each light outlet 56 may be shaped to spread or focus the issuing light.

Fig. 9 illustrates a tray 18 according to the invention which is essentially the same as that of Figs. 7 to 8 but which is designed to be illuminated along two opposed sides. In this instance, two Fresnel lenses are provided, one along each of two opposed parallel edges of the tray 18, and each runner 28 has an underside providing first reflective surfaces 60 for directing light from the right-hand lens through the light outlets 56, and a laterally adjacent set of reflecting surfaces 62 for directing light from the left-hand lens out through the said light outlets.

Figs. 10 and 11 illustrate another egg setter tray according to the invention which is basically similar to that of Fig. 9, but which has upstanding members 50 arranged to support the eggs 34 on their sides. As with the Fig. 9 embodiment, that of Figs. 10 and 11 is designed to be illuminated from two opposite sides, with the underside of each runner 28 providing two laterally adjacent sets of reflecting surfaces for directing light out through the spaced light outlets. In this case, the issuing light passes up upstanding member 63 and is reflected from surface 64 to illuminate the air sac end of the adjacent egg.

Figs. 12 and 13 show an illuminating overlay according to the invention which can usefully be employed in conjunction with conventional non-illuminating egg setter trays. The illustrated overlay 20 is an integral moulding of transparent synthetic plastics material which can be mounted over a conventional tray in a conventional stack to illuminate locally the upturned air sac ends of the eggs on a tray below. The overlay consists of an integral moulded sheet 70 having an array of holes 72 there-through to allow for adequate ventilation. The upper surface of the sheet is formed with an array of conical indents 74 whose reflective surfaces direct light passing through the sheet downwardly through corresponding localised light outlets 76 onto the ends of eggs housed in a tray below, the light outlets being arranged in register with the egg ends. The overlay 20 is moulded integrally with two Fresnel lenses 78 which extend along the full length of respective opposed edges of the overlay. The illustrated overlay is designed for use with an external light source such as that of Figs. 1 to 3, but could equally well be

provided with means for securing its own light source (e.g. a fluorescent tube) parallel to and along the length of each light receiving edge.

The exposed edges 80 of v nts 72, and the
5 exposed external edges 82 of the sheet 70 are shaped to be retroreflective and hence to conserve light within the overlay, reducing its dissipation through these edges.

The invention thus provides for the desirable
10 uniform local illumination of incubating eggs with efficient utilisation of the light supply, and it permits this to be achieved with equipment of standard form, so that application of the invention does not necessitate the expense of the wholesale replacement of
15 existing equipment by new.

CLAIMS

1. A method of incubating eggs in which the incubating eggs are supported in an array on a tray and are illuminated locally at their air sac ends by an
20 array of individual light beams from an array of localised individual light outlets spaced apart over light guide means receiving light from an external source and constituting at least part of the tray or of a vertically adjacent member or members generally co-
25 extensive with the tray.

2. A method according to claim 1 wherein the light guide means constitutes at least part of a member vertically adjacent to the tray.

3. A method according to claim 2 wherein the
30 member is another egg tray.

4. A method according to claim 2 wherein the member is an illuminating tray overlay.

5. An egg setting tray incorporating an array of receptacles for holding respective individual eggs
35 and, extending adjacent to the array, a light guide or guides having portions able to receive light from an external source and having individual localised light outlets which are spaced apart over the tray for locally directing such received light away from at least
40 one face of the tray in an array of individual beams.

6. An egg setting tray incorporating an array of receptacles for holding respective individual eggs and, extending adjacent to the array, a light guide or guides having portions able to receive light from an
45 external source and having individual localised light outlets which are spaced apart to direct such received light locally to an end of each receptacle of the tray.

7. A tray according to claim 5 or claim 6 having
50 structure defining the receptacles with at least part of the structure being of light-transmitting material and constituting the light guide or guides.

8. A tray according to claim 7 which is an integral moulded unit of light-transmitting material.

55 9. An egg setting tray substantially as hereinbefore described with reference to Figs. 4 to 6 of the accompanying drawings.

10. An egg setting tray substantially as hereinbefore described with reference to Figs. 7 and 8 of the
60 accompanying drawings.

11. An egg setting tray substantially as hereinbefore described with reference to Fig. 9 of the accompanying drawings.

12. An egg setting tray substantially as hereinbefore described with reference to Figs. 10 and 11 of

the accompanying drawings.

13. An illuminating overlay for an egg setting tray, the overlay comprising a light guide or guides having portions able to receive light from an external
70 source and having individual localised light outlets which are spaced apart in an array to direct such received light locally away from at least one face of the overlay in a corresponding array of individual beams.

75 14. An overlay according to claim 13 comprising an integral moulded unit of light-transmitting material constituting the light guide or guides.

15. An overlay according to claim 14 with at least one edge which has a light-collecting lens integral
80 therewith and extending therealong for directing light to light receiving portions of the overlay.

16. An overlay substantially as hereinbefore described with reference to Figs. 12 and 13 of the accompanying drawings.

85 17. Egg incubation apparatus comprising egg support means providing receptacles disposed in a first array for holding respective individual eggs in a corresponding array, and light guide means extending adjacent to the first array and disposed to receive
90 light from an external source, the light guide means having individual localised light outlets which are spaced apart in a second array to direct such received light locally towards an end of each receptacle.

95 18. Apparatus according to claim 17 wherein the egg support means comprises a plurality of egg setting trays and means mounting them one above another, each tray providing a plurality of the receptacles.

100 19. Apparatus according to claim 18 wherein the localised light outlets to direct light locally to the ends of the receptacles of a tray comprise those of a light guide or guides provided by a vertically adjacent tray or trays.

105 20. Apparatus according to claim 19 wherein the light guide or guides constitute structural parts of the vertically adjacent trays.

21. Apparatus according to claim 20 wherein the receptacles are defined at least partially by the light
110 guides.

22. Apparatus according to claim 18 including light guide components alternating vertically with the trays and having the localised light outlets to direct light locally to the ends of the receptacles of
115 adjacent trays.

23. Apparatus according to claim 18 wherein the trays are according to any of claims 5 to 12.

24. Apparatus according to claim 22 wherein the components are overlays according to any of claims
120 13 to 16.

25. A method according to claim 1 wherein the tray is according to claim 6; according to claim 6 together with claim 7 or 8; or according to claim 10, 11 or 12.

125 26. A method according to claim 3 wherein the tray is according to claim 5; according to claim 5 together with claim 7 or 8; or according to claim 9.

27. A method according to claim 4 wherein the overlay is according to any of claims 13 to 16.

130 28. An illuminating trolley suitable for use with

- apparatus according to claim 18, the trolley comprising a wheel base supporting a casing housing an upright bank of light sources back d by reflector means, the wheeled trolley also supporting c nnec-
5 tor means for controlledly connecting the light sources to an electric supply.

29. An illuminating trolley substantially as hereinbefore described with reference to Figs. 1 to 3 of the accompanying drawings.

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